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# *2004-Newer VW Installation Instructions*



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**GOLDEN FUEL SYSTEMS SVO INSTRUCTIONS**

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# Chapter One – Overview of Components

## 1.1 Necessary Tools

To start your installation it will be beneficial to have a few tools and supplies handy:

- A good sharp knife or hose cutter (optimal) to cut hose.
- General all purpose wrench selection for a variety of applications, including adjustable for fitting installation.
- Hand Vacuum Primer Pump for Priming Coolant and Fuel Lines and Troubleshooting (cuts down on priming frustration and allows for quick diagnosis of restriction or air issues.)



Hand Vacuum Pump available at [www.goldenfuelsystems.com](http://www.goldenfuelsystems.com)

- Some rags or shop towels to keep things wiped up and clean.
- Although you can use screwdrivers for the hose clamps it is highly recommended that you get some nut drivers to tighten the hose clamps. They don't slip off and will be a great addition to your toolbox. You will need 1/4" and 5/16" nut drivers. They are cheap, and easy to find at any hardware or automotive store.
- A screw gun or drill will also be handy. Again, 1/4 and 5/16 driver bits are a real help. The self-drilling screws for mounting the hardware of the kit are easily installed with the screw gun.
- A set of wire pliers (strippers and crimpers.)
- Some pipe joint compound (also known as *pipe thread sealant*). *Special note: We do **not** recommend the use of Teflon tape in place of pipe joint compound. Teflon tape is much more likely to leak (either air in or fuel out), and requires a proper technique to apply properly for best results. We like the fool-proof 'smear-n-go' philosophy of the pipe joint compound.*
- 2" hole saw to cut a hole in the trunk of your car (or the bed of your truck) to run the Triple bypass hose (from here on out we will refer to it as 3B hose).
- Supply of coolant for your vehicle, depending on year we recommend getting a universal formula for all types of coolant.
- Digital Volt/Ohm meter. These are less than 20 dollars at most auto part stores and far superior to a test light. We do not recommend a test light because of its potential to damage complex computer circuits.

## 1.2 Preparing the Installation

The first step to ensure your installation will be as successful as possible is to study your stock fuel configuration and familiarize yourself with the vehicle. Haynes or Chiltons manuals are a great resource for understanding your vehicle. You may purchase them at a local autoparts store or try borrowing them from your local library.

Allow yourself adequate time to complete the installation. These installations can run 20+ hours depending upon your mechanical ability or if any issues arise. Avoid mistakes by carefully reading and understanding the installation guide. Call us for any questions.

## 1.3 Components

### 1.3a Pollak Fuel Selector Valve



The Pollak 6-port fuel selector valve (Figure 2) can be mounted in the engine compartment. The physical size of the valve automatically limits it to a few locations in the engine compartment within acceptable distance from the injection pump. The most reasonable location would be mounted to the engine between the front bumper and block. If your VW still has the TDI cover, removing this shield opens up a lot of usable space to mount the valve. The material that the valve is mounted to does not matter because this valve receives its grounding from the wiring harness. Ensure that it is clear of any hot or moving parts. You can secure the valve with two 5/16"-18 x 1" bolts (included with the kit) or just use cable ties to hold it in place. You may need to fabricate a bracket for it to mount securely.

The valve is equipped with a 5 wire harness. Only two of these wires are used by your GFS system. These wires are D, aux fuel circuit, and E, main fuel circuit. You will be using these polarity wires to not only move the valve, but also to control your auxiliary pumps during the wiring process.



**Toggle Switch**

**The toggle switch** (provided with the 6 port fuel selector valve) will be mounted through a 15/32" hole usually on the dash within easy access of the driver. Depending on the body style of your TDI, there are a lot of different places to put this switch, up to and including the center console. Your biggest limiting factor will be the size of the switch body, so remember to take this into account before you drill any permanent holes. The panel directly in front of your knees usually provides a good home; it will be necessary to remove panels and verify if that location will work in most situations. Be careful not to push too hard on any plastic panels as you are drilling; they are often brittle and easy to damage. Push the toggle through the hole and secure it with the locator tab and nut provided in the Pollak switch box. Follow the supplied wiring instructions within the Pollak box.

*(special note: If your vehicle is brand new and you would like to preserve the dash, a good option is to fabricate a bracket to hold both the switch and gauges and hang it from bolts under the dash.)*

### **1.3b Racor SVO Filter**



**6120**

#### **Racor 6120**

The spin on Series Filters all have mounting holes cast into the filter head. They will need to be bolted to a solid foundation in an upright position. Because of space limitations in most VWs, the best place to mount a filter is in the trunk. The filter heads have seven ports. Four of them are inlets and three are outlets. They are designated by arrows

that are cast into the head by the ports. Only one of each is to be used while the others will be plugged with the provided 3/8" NPT plugs. This allows multiple configurations for different applications. Remember that this filter is a spin on bottom loader style element. There may be spillage during changing, so take this into account when and where you place it in the trunk.

*(If mounted to a Trekker tank, mounting location will be less of an issue, but because of the variety of options for tank location, we recommend a plastic style trunk mat for newer vehicles and/or for anyone who would like to minimize any potential oil mess.)*



**1000FH with the Exclusive GFS Thermostatically Controlled Heater at 175°**



**900FH with the Exclusive GFS Thermostatically Controlled Heater at 175°**

### **Racor 900FH, 1000FH**

Racor turbine series filters must be mounted as close to vertical as possible. If you are not mounting it to a Trekker series fuel tank, do not exceed 10° from vertical or the assembly may not function properly. The see-thru contaminant collection bowl allows the operator to check for water and solid contamination at a glance. Overhead Clearance needed for Turbine Series Filters: 5" – 12". Allow for at least 2" clearance under the unit for draining water from the collection bowl. Turbine series filter assemblies are designed to be installed on the vacuum side of the fuel transfer pump for best efficiency. These filters include an internal 12V, 300 watt Heater with Golden Fuel Systems exclusive thermostat that brings oil temperature up to 175° degrees. These filters do not use an external heater wrap.

**WARNING! DO NOT ACTIVATE THE HEATER WITHOUT FUEL IN THE FILTER! THIS CAN PERMANENTLY DAMAGE THE HEATER ELEMENT AND/OR FILTER! REMOVE THE FUSE IF THE FILTER IS GOING TO BE EMPTY OR NOT RUNNING FUEL THROUGH IT FOR EXTENDED PERIODS WHILE ACTIVATED (36 hours or more.)**

Adjustable one-piece clamp-type mounting brackets, with grade 5 fasteners, are included for ensured durability. One 2-micron Element is installed in the Filter. 2 adapter bushings for 3/8" MPT Fittings are included.

Elements other than genuine Racor cartridges will NOT open the shut--off valve and are not recommended for use with the new FH Turbine Series. The new element design will fit ALL older versions of Racor's Turbine Series, however, old element stock (those with full colored end--caps and the single center bail handle) will not fit or open the shut--off valve in the new FH models.

### **1.3c Accessory Fuel Pump**



### **Accessory Fuel Pump (actual pump may vary from image)**

The Accessory fuel pump is a 12volt electric pump, used to assist pushing the SVO up to the factory lift pump. It is always to be installed on the outlet side of the veggie filter to prevent pressurizing and potentially damaging the Racor Filter. The best place is directly mounted off of the filter itself, using the fittings themselves to hold the pump securely.

### **1.3d/Triple Bypass (3B) Hose**



### **3B Hose**

This hose was designed exclusively by Golden Fuel Systems and produced by Parker for SVO use. The two 1/2" coolant hoses supply and return hot engine coolant to your hot SVO tank while simultaneously keeping the 3/8" fuel line hot from the tank to the engine compartment. These are 3 separate hoses encased in a rubberized PVC sheath. This is the safest and most efficient way to run a heated fuel line. The hoses are extremely durable and can be run under the car without fear of rupture or failure. Plumbing of the Triple Bypass hose is a painless process as long as you've planned ahead. Due to the variety of body styles that hold the TDI powerplant, you may encounter routing difficulties that are not depicted in the photographs. For this reason, take care to make sure that your hose routing will actually work without kinking. Make sure you have a clear path into the engine bay and the trunk. General plumbing diagrams are in the next Chapter.

### **1.3e Vacuum/Pressure Gauge**



### **Vacuum gauge – Color may vary**

The Vacuum/pressure gauge is an added feature that allows one to monitor both fuel systems. It can indicate when there is restriction in the line and assist in diagnosing issues, should they arise. We recommend mounting this on the engine side of the Pollak Valve. Readings will vary from vehicle to vehicle, but they should be in the 10 inches of vacuum to 10 psi range. Racor Vacuum Gauges are available that can mount directly on the Racor Filter housing and indicate when the filter needs to be changed.

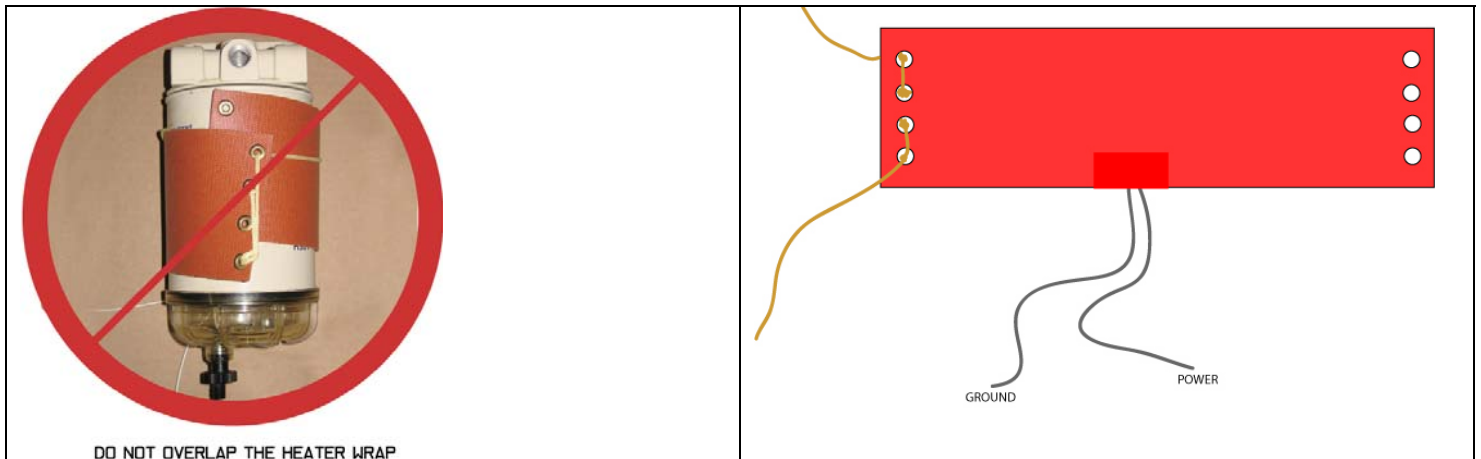
### **1.3f Fuel Level Sending Unit and Gauge**



**Fuel Gauge- Color may vary**

The Fuel level sending unit and external gauge allows one to monitor the fuel level in the SVO tank.

### **1.3g External Heater Wrap (Racor 600 Series Filters Only)**



The external heater wrap is secured by a shoelace style system. It should be tight but not overlapped. If it is overlapped then it is not the proper size for the filter element. It is better to have some exposed filter element so that the wrap will not overheat. The Golden Fuel Systems electric heater wrap is a 12 volt electric resistive wrap that we use to heat our vegetable oil filters. We recommend the wrap to be secured as tightly as possible on the lowest point of the filter housing but not overlapping itself. Ensure that the wrap is not pinched under any mounting brackets or between anything that could damage the internal wires. The wrap has two white wires. One wire is to be 12 volt key on fused power and the other wire is to be a ground. It does *not* matter which one you choose for which operation. The wrap is a resistance type heater element, so power and ground are interchangeable. We wire this through a relay that is controlled by the ignition key, but it may also be wired to a separate switch for added control. We recommend that the customer wraps the entire filter and heater wrap with the supplied bubble wrap insulation to prevent the heat from being wicked away. The wrap will only be included in a kit that has a spin on 600 series filter.

## Chapter Two – VW Plumbing Diagrams

On the 2004 and newer VW TDI applications, stock fuel delivery is handled by an in-tank lift pump in addition to the injection pump suction. This is the largest single relevant difference between these and previous years, and to successfully run on vegetable oil, it will be necessary to shut this in tank pump off and activate a vegetable oil specific pump. A stepper motor activated, high pressure 6-port Pollak Switching Valve will be used in this application to easily facilitate the required wiring. This Pollak 6-Port Valve will actually be utilized as a 3-port valve as we will be disregarding the 3 return ports on the Pollak valve.

VW has usually marked the fuel system flow on the hoses themselves. The easiest way to trace everything is to start at the stock fuel filter. From there you will have clearly marked supply and return fuel lines. Both supply and return will be attached to the filter head. However, the return line will be identifiable because it travels to a plastic temperature valve on the filter head that will need to be bypassed during the installation.

### **2.0 Bypassing the Stock Filter Thermostatically Controlled Valve**

The purpose of this Thermostatically Controlled valve on the Stock Filter is to allow the engine to preheat the diesel fuel by returning hot fuel from the engine back to the filter instead of sending it to the tank. At 80-90°, the valve opens up, allowing the return fuel flow back to the tank. It is necessary to bypass this valve, as it would be difficult, if not impossible, to purge air out of the looped SVO/Diesel system when the engine is cold due to the Stock Filter Valve Loop. The air would cycle through the stock filter, instead of returning to the diesel tank.

You will need to address this issue by cutting the valve out of the return line. Attach a loop from one end of the valve to the other and butt-connect the return line from the injection pump to the return line going to the tank.



VW Stock Filter with Thermostatically Controlled Valve Not Bypassed





VW Stock Filter with Thermostatically Controlled Valve Bypassed – Note the Loop

## ***2.1 Installing the Pollak Switching Valve and 3-way Brass Valve***

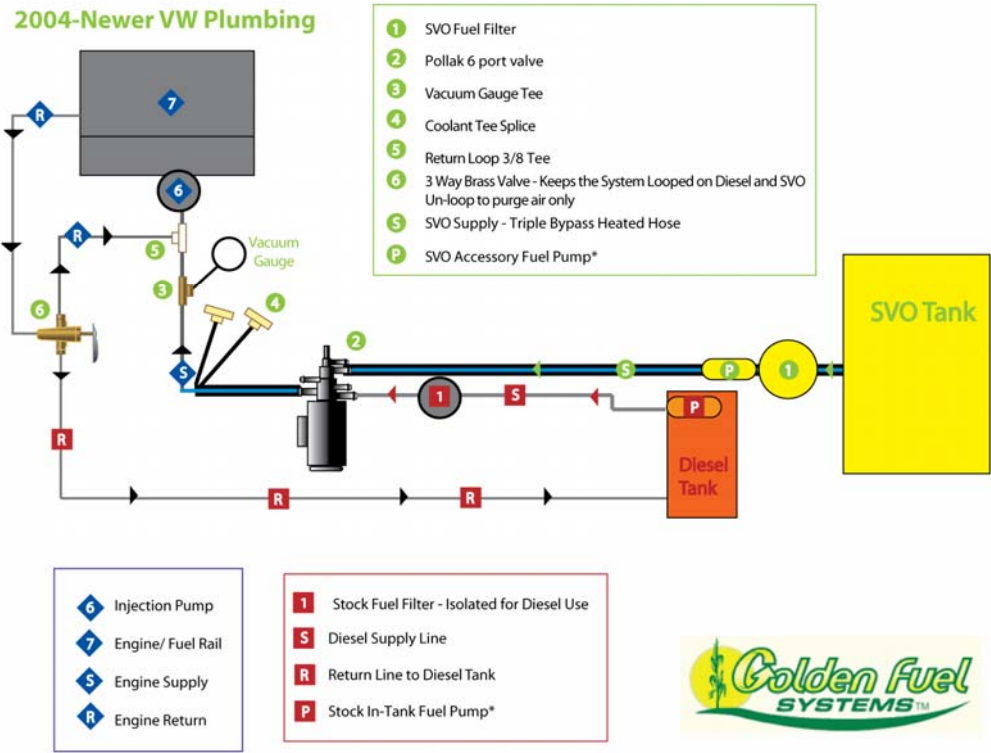
Install the Pollak valve in the engine compartment reasonably close to the injection pump. Install the brass 3 way valve, as well. In many cases, with the necessity to fabricate a bracket, you can easily mount both valves to the same support. Remember to allow room to turn the handle of the brass valve if needed. It must be able to sweep 180 degrees to be fully in either position. Essentially, by not utilizing the return ports on the Pollak valve (the smaller ports,) the Pollak 6-port Valve is being substituted for a 3-port.

The brass valve will control the return line, with return from the engine coming to the bottom of the brass valve, one of the discharge ports running back into supply, and one returning to the diesel tank. This system is designed to run in looped mode at all times unless dealing with an air issue. You will not need to continually move the brass valve, its purpose is to control fuel return for specific situations.

## 2.2 Plumbing Diagram

Below is the plumbing diagram for the 2004 and newer VW's. The lift pump is responsible for supplying the injection pump with all the fuel it needs. The injection pump is responsible for delivering fuel to the injectors in a precisely measured and timed sequence. These lift pumps are installed in the diesel fuel tank.

- P** Diesel In-Tank Pump
- S** Diesel Supply Line
- R** Return Line to Diesel Tank (Air Purge)



\*Both the In-Tank and SVO Fuel Pump must be wired to the switch so they are activated and deactivated properly.

## 2.3 Routing the Triple Bypass Hose (3B)

When planning where you are going to come up into the engine compartment or trunk, you will need to take into account where your heater hoses are and where your tank and Racor filter is mounted. Start securing the hose under the car. Make sure there is enough hose in the back to get to the farthest fitting you need to reach. Leave a few extra feet to make sure that you can completely follow the fuel line with coolant line, and be able to connect to the coolant fittings. It is always far better to have too much hose, than too little. **Do not leave any blue fuel hose exposed. Insulate it with coolant lines and sheathing or bubble wrap, if necessary. Even a foot of exposed blue fuel line in cold weather can create a slug of cold SVO that might result in restriction that will immobilize the SVO System.**

There are a few ways to run the hose up into the engine compartment. Your final termination for fuel line is the injection pump or near, and you can either come up on the passenger side near the coolant reservoir, or up behind the block on the driver side. The most important things to remember are to allow enough play in the hose for engine movement, and to avoid any direct contact with the exhaust manifold. 3B is incredibly tough, and the sheath is fire

retardant, so close proximity is ok, but you want to avoid actual contact. Remember that things will move over time, so it is best to completely avoid any chafing or melting issues in the first place.

Once inside the engine compartment with the 3B hose, you will need to trim back the rubber sheath to expose the individual hoses so they can go to the various points they will need to go to. There is a Kevlar string inside the hose that you can pull on to split the sheath length wise. Sometimes you will need to use a knife to split the sheath to expose the string. There is a clear wrapping inside the 3B hose that will be exposed when you split the sheath. This clear wrap is only there to protect the internal hoses from the shrink wrapping process during the 3B manufacturing process. You can discard any that you expose. **Planning is the key to running the hoses: take some time to plan things out and it will go smoothly.**

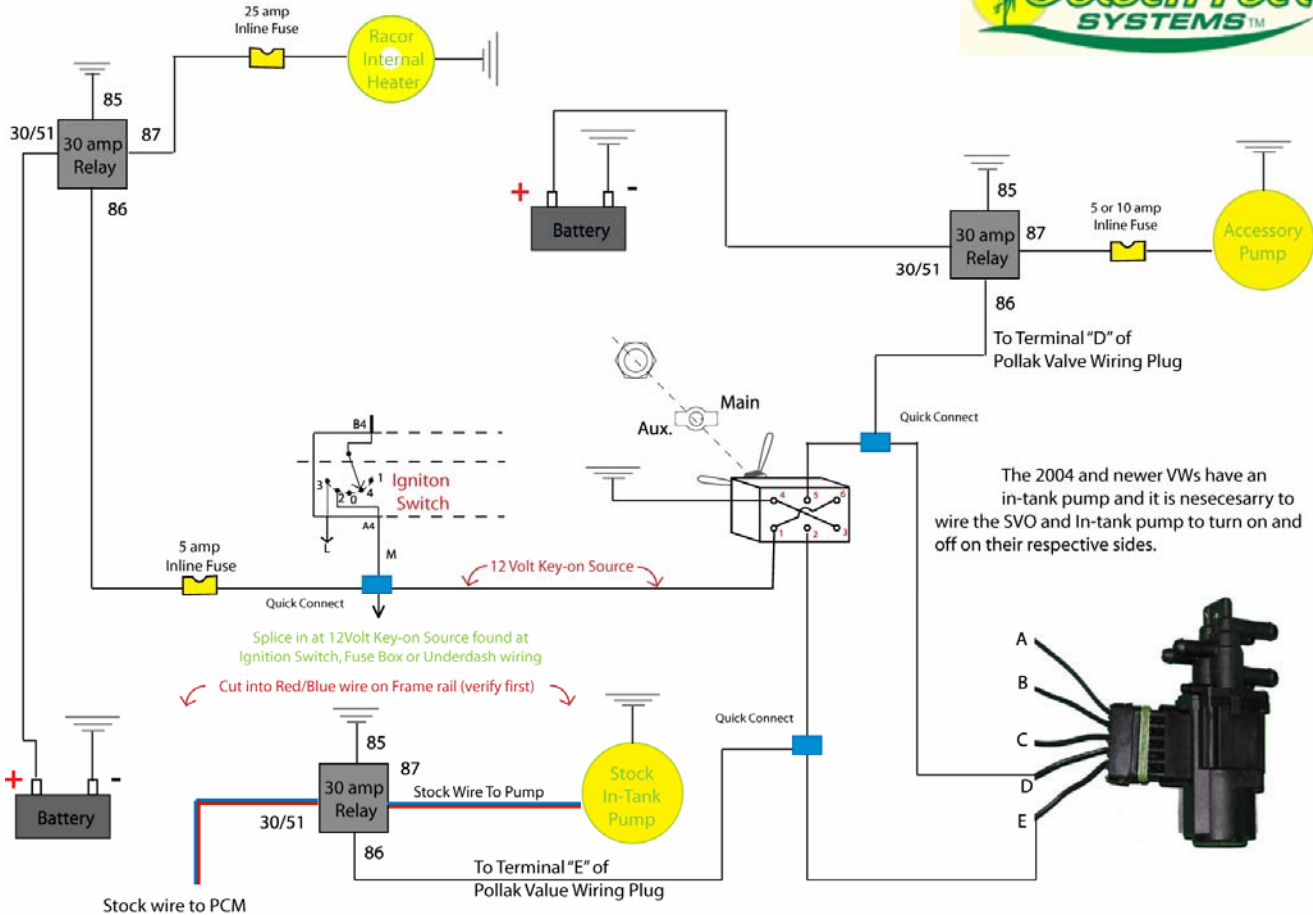
Decide which heater hoses you are going to splice into and where you will install the splice. You will need one supply hose and one return hose. There are a few different options for TDI applications. On the diagram of the coolant system provided, you will see that the TDI has a fairly complicated routing. We use one of two options; 1, a parallel circuit off of the heater hoses, (most normal applications), or 2, if the heater hoses are obscured, you may decide to put the vegetable system in series with the oil cooler line. This connection is easily made, located on the driver side of the engine compartment. You can find it by the oil filter housing and tracing hoses. However, it is important to remember that it will be in series, not parallel. You will not T into these lines, but join the hoses end to end. You will splice into the coolant line and install the two 5/8" x 5/8" x 1/2" tee's (provided with the kit) with the 4 large hose clamps (provided with the kit). Some vehicles will require two 3/4" x 3/4" x 1/2" tees, or 5/8 to 1/2 butt connectors depending on application. Please contact us if your installation needs them.

Next, trim the coolant lines of the 3B to the correct length, install one medium hose clamp per hose, and push them completely onto the tee that you just installed. Next trim the blue fuel line of the 3B hose to the correct length, install one small hose clamp, and push it completely onto the 3/8" NPT x 3/8" barb fitting (provided with kit) that is installed in the inlet port of the filter head. Go back and double check that all hose clamps are tight. Once your conversion is complete, be sure to check your coolant level and add as needed. While some installs lose almost no coolant when you cut into the heater hoses, others wind up with a serious loss, and replacement is mandatory!

# Chapter Three – Wiring

## 3.0 Pollak Switching Valve Wiring Diagram

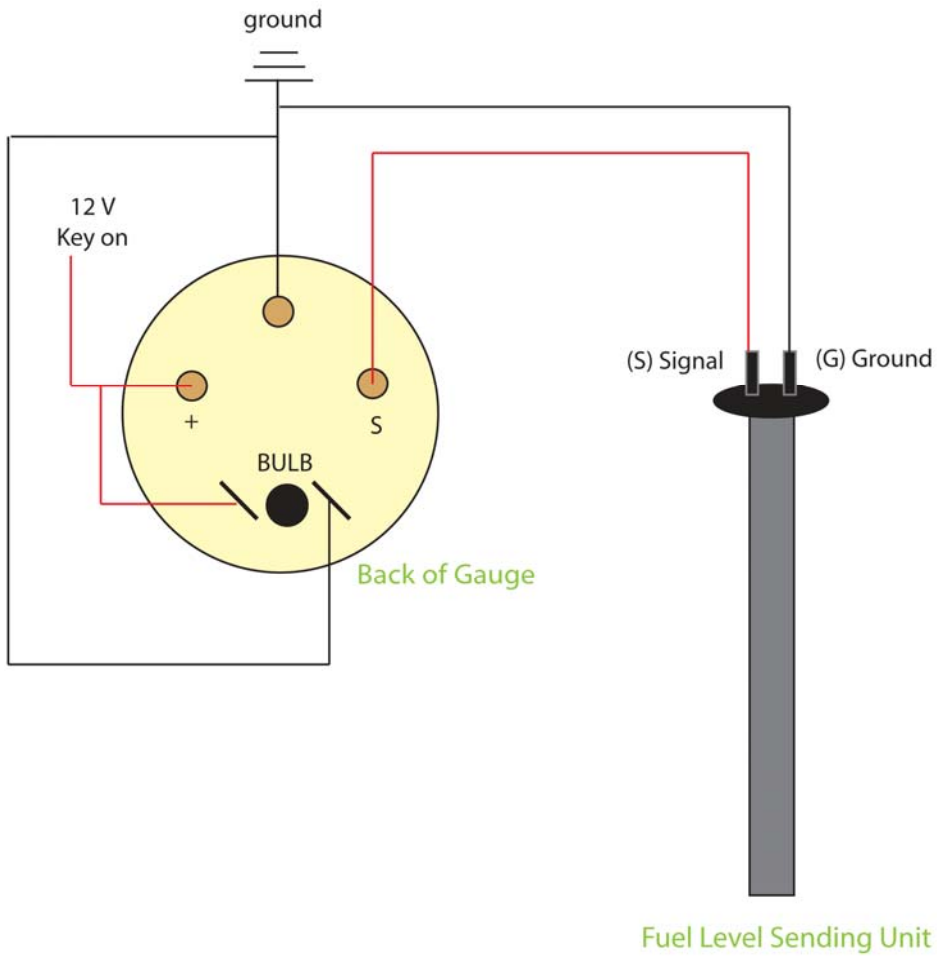
2004-Newer VW Pollak Switching Valve Wiring Diagram



### 3.1 Finding a 12 volt "key on" source

You will need a Digital Volt/Ohm meter (DVOM). You need to find a wire under the dash that only has 12 volts when the key is in the "RUN" position. It will not have power in the "OFF" position or the "ACCESSORY" position. For your TDI, 12 volt power can easily be found in the fuse box. You accomplish this by back-probing the wire or fuse holder with the red lead and then grounding the black lead. Remember to take power from the side of the fuse holder that provides power. The way to do this is to remove the stock fuse completely, then probe which side has 12 volts. Attach your power line from this side, the reason for this is not to run your vegetable signal circuit through an additional fuse for another application, possibly overtaxing one or both. It should read 0.0 volts when the key is off but will read approximately 12 volts when you turn the key forward to the "RUN" position. This is two clicks forward, just before you begin operating the starter, when the dash lights and buzzers come on.

### 3.2 Wiring of Fuel Level Sending Unit and Gauge



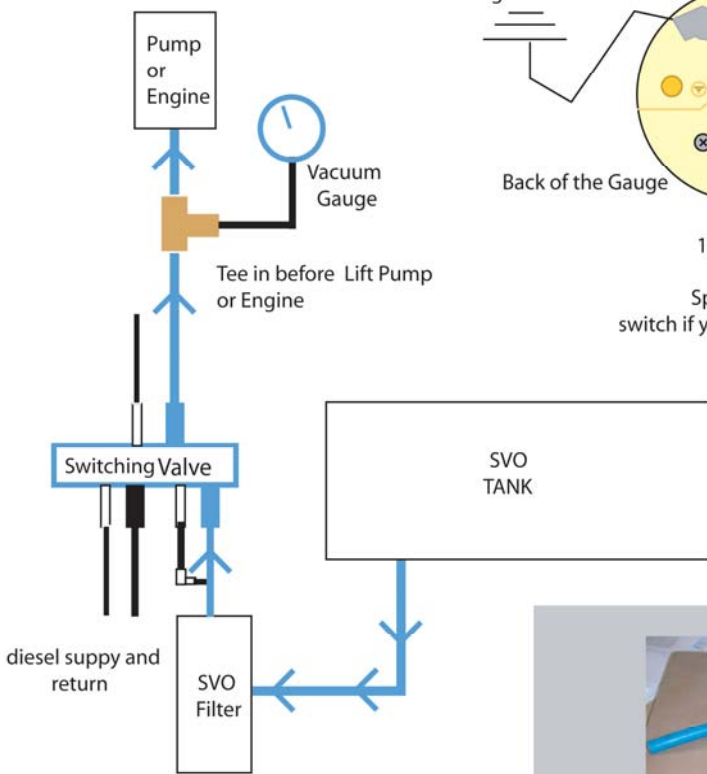
***Actual Fuel Level Sending Unit Might Vary From Diagram***

### 3.3 Vacuum Gauge Set-up

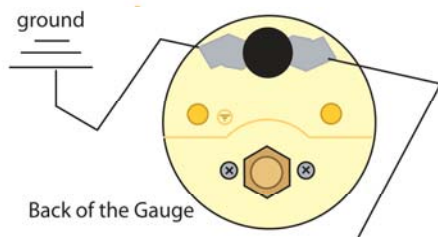
The vacuum/pressure gauge allows one to monitor and diagnose the SVO system. The gauge registers resistance of the fuel moving through the fuel system. However, on most vehicles, the gauge will initially read pressure of 10-14 lbs as the SVO in-line fuel pump outputs this much pressure. If there is no SVO in-line pump, the gauge will register vacuum. The vacuum the gauge will register depends on the vehicle. When the vacuum reaches 10-15 inches of vacuum, this usually indicates a clogging fuel filter. Make note of where on the gauge the vehicle starts to hesitate and “bogs” down and this is when the filter needs to be changed in the future.

With a pressurized system, the pump can mask a clogged filter until the vehicle begins to accelerate. With a clogged filter, the pressure will seem to remain between 9-14 psi until accelerating at which point the needle will drop significantly to 0-5 psi. Depending on the vehicle, there may be symptoms of restriction at any of these vacuum or pressure points mentioned. Make note of where on the gauge the vehicle starts to hesitate and “bogs” down and this is when the filter needs to be changed in the future.

PLUMBING FOR VACUUM GAUGE



WIRING FOR VACUUM GAUGE



12 Volt Key on source  
OR  
Splice into the dimmer switch if you want to be more creative.



STEP I



STEP II



STEP IV

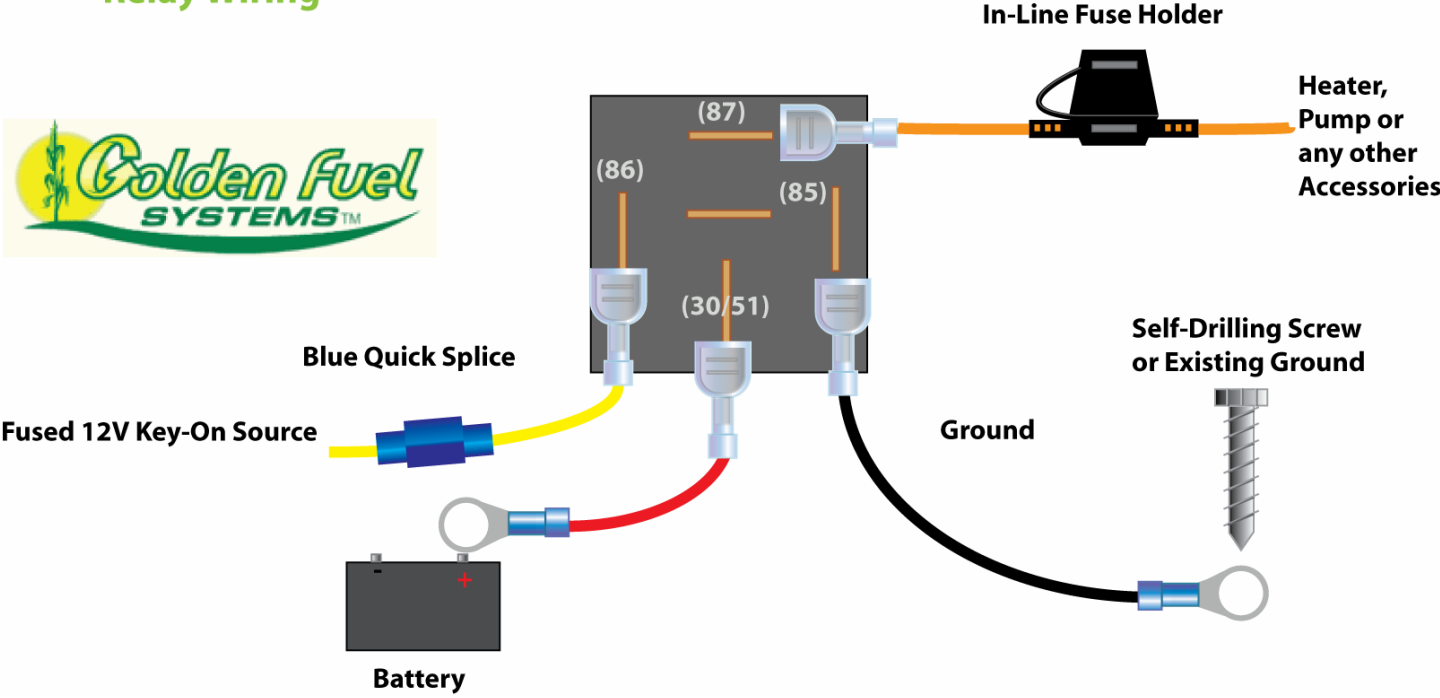


STEP III



# 3.4 Wiring Relays

## Relay Wiring



## Chapter Four - Finishing the Conversion

### 4.0 Finishing Checklist

So you think you're all set and ready for a test drive? Let's run through this checklist to highlight the critical points of finishing off the conversion.

- Make sure all Hose Clamps are tight.
- Check the grounds from relays, sending units and pumps to ensure metal contact.
- Remember to prime Filters with diesel or veggie (we recommend using the Mity-vac Hand Pump to pull fuel through to fully prime the line.)
- Remember to prime the lines with diesel or veggie (we recommend using the Mity-vac Hand Pump to Pull fuel through and check for air bubbles or use the fuel pumps to prime.)
- Insert all the fuses at this point.
- Change your stock filter so you know everything in the fuel line is new.
- Prime your coolant lines by using a pump or the old-fashioned way of driving and filling when the air bubbles work themselves out. Keep a couple of gallons of coolant with you in the vehicle when you go for the test drive and check the coolant level. We recommend drawing coolant through the lines as well. It may take up to 10 miles to fully purge air out.
- Make sure you have at least half a tank of Diesel, but not full to the brim. You will most likely have to purge air bubbles in the veggie system to the diesel tank and you don't want to overflow a full tank. For more on air purging check section 5.2.

You should be all set at this point. If you flip over to veggie, it should be a smooth transition. If you feel a hic-up or two, it might be an air bubble you need to work out of the system by flipping over to diesel and back to veggie again. Air in the system will cause a shuddering and jumping sensation, while clogged fuel filters will cause a slow restriction, leading to a gradual loss of power. If you have any questions after this point please contact us via e-mail, fax or phone.



## Chapter 5 - Troubleshooting

### 5.0 Recently Installed System

**I switched over to SVO and the vehicle sputtered and coughed and the engine cut out. What should I do?**

Most likely, the fuel lines weren't primed properly and there was air left in the system that caused the engine to turn off. Prime the fuel line by disconnecting the SVO fuel line to the switching valve and turning the accessory fuel pump on or using a hand vacuum pump until the fuel flows without any air bubbles. Reconnect the fuel line to the switching valve and tighten the hose clamp. Make sure that you are on the un-looped diesel system when you attempt to start the vehicle. If the vehicle is air-locked it might take several attempts to start the vehicle again and to purge out the air from the system.

**I've been running the car for 15-20 minutes and the vehicle is up to temperature, but the tank isn't warm. What should I do?**

Most likely, the coolant lines weren't primed properly and there is air left in the system that isn't allowing the coolant to flow properly. Prime the coolant line with a water pump or hand primer pump. You might have to cycle the coolant a couple of times to purge the air pockets completely. Make sure to check your coolant level, as well.

### 5.1 Mature System

**I switched over to SVO and am experiencing acceleration issues and lack of Power. What Should I do?**

Most likely, there is restriction in the SVO system. This is usually caused by a clogged veggie filter. Change the veggie filter. Don't forget to prime it (fill it up with fuel) and make sure that it is sealed well.

**I changed my SVO Fuel Filter and am still experiencing acceleration issues and lack of Power. What should I do?**

If you are running a system that utilizes the stock fuel filter for both veggie and diesel, you might need to change the stock fuel filter.

**I changed the SVO and Stock fuel filter and am still experiencing acceleration issues and lack of power. What should I do?**

Most likely, there is some other source of restriction that will have to be traced down. Restriction can be caused by numerous foreign objects that get pulled up into the system or by cold veggie. If you found that your system was running fine in the warmer weather, but now has had a couple of hic-cups with the onset of cold weather, we would advise checking your system for any sources of heat leaking such as exposed fuel line, unwrap filters or coolant deficiencies. For the extreme cold climates, there are a couple of inline heaters and heated fuel pick-up upgrades available on our website. **Do not leave any blue fuel hose exposed. Insulate it with coolant lines and sheathing or bubble wrap, if necessary. Even a foot of exposed blue fuel line in cold weather can create a slug of cold SVO that might result in restriction that will immobilize the SVO System.**

**I switched over to SVO and my vehicle began to sputter and cough and the engine cut out. What should I do?**

Most likely, there is air that has been introduced to the system. If you just changed your fuel filter and didn't prime it properly, that could be the source. If you primed the filter properly, check to make sure that there is nothing loose on the filter. If nothing on the system has been changed recently, then the air leak will have to be traced down. A hand vacuum pump is convenient to trace down air leaks. Check all hose clamps and fittings for a secure fit, as well.

## 5.2 SVO Cold Starting

*You forgot to shut down on diesel!* This is part of the "SVO Learning Curve." Most folks running SVO have done it and chances are that you will, too. Every once in a while, we act like humans and forget to flip that switch before we shut down for the night. Don't panic, it's an easy fix and it doesn't harm your vehicle. Here are a few recipes that'll get you back on the road.

The first thing to do, before any of the following suggestions, is flip your fuel selector switch to Diesel. If the weather is above 45 or 50 degrees simply cycle your glow plugs twice and start the vehicle. It will likely require more cranking than normal but once it fires up it should clear out. Keeping your accelerator 50% engaged will help matters. If this approach doesn't work, try some of the suggestions below. These suggestions can be used separately or together (in the event of particularly harsh weather). **When cranking, be sure not to run your starter for more than 30 seconds at a time, allowing it a 60 second break between attempts, otherwise there is a risk of burning up your starter.**

1. **Plug in your block heater.** You can plug in your block heater and wait a couple of hours. Then cycle your glow plugs once or twice and she'll likely pop right off with minimal cranking of the starter. Just about every diesel has a block heater and sometimes they're worth their weight in gold.
2. **Place the vehicle in a heated garage.** If you are parked in a garage and it can be heated then by all means turn the furnace on.
3. **Heat via light.** You can place an incandescent or metal halide (fluorescent lights will not get hot enough) shop light shining on your injection pump, wait about an hour, cycle your glow plugs, and she should fire up!
4. **Hair dryer or heat gun.** Blast hot air on your injection pump and injectors until they feel warm. Cycle your glow plugs and crank her up.

## Chapter 6 - Gathering SVO

It is highly recommended that you watch the DVD Liquid Gold available from [www.goldenfuelsystems.com](http://www.goldenfuelsystems.com) that deals specifically with collecting and filtering oil. Pictures are worth a thousand words and moving pictures with commentary are priceless.

### 6.0 Seven Golden Rules of Gathering SVO

**Gathering Rule #1:** Drive around back and inspect the oil before asking the owner if you can take it. The last thing that you want to do is make contact with a manager and then get permission to take the oil only to find out that the oil is less than desirable.

**Gathering Rule #2:** When checking for oil quality, note the consistency, color, and clarity of the oil.

**Consistency** - Open the bin, peer in, and kick the side of the bin to generate a bit of a wave. If it doesn't move at all (provided it's not a concrete grease trap), walk away. Even in 30°F weather, there should be some fluidity to it (for more information on gathering in the cold, see the next section Wintertime Gathering, definitely worth your time).

**Color** - If, looking down into the bin, you note the color of the oil is creamy, thick and milky looking, decline the oil. While such oil is certainly usable, it usually eats up more time and filter bags than it's worth. The milkiess is more free fatty acids (aka FFA's) and likely more water than you want to mess with. The actual color does not matter. It can look like new Wesson oil straight off the shelf, light ice tea, or maple syrup. The color will vary mattering on the type of oil (canola, peanut, coconut, etc.), what was cooked in it, what temperature they cooked at, and how long it was used.

**Clarity** – This is the most important test of all. This test is for warm weather collecting. Find a clear container and take a sample of the oil. Hold the sample up to the sun or a bright light and check the clarity. You should be able to see through the oil to the other side. If you can see through it then by all means it is great oil and I would collect it for use in my vehicle. If it is just a little hazy then I would take the sample home with me and let it set for a while to see if the oil settles out. If in a couple days the sample that you took settles out and looks clear when held up to a light then it is good oil. I would go back and collect the oil. Then take the oil home and let it settle out for a few days (or a couple weeks if possible).

The longer you let the oil settle then the more sediment will settle out and the longer your pre-filter bags will last! If it is cold outside and the oil in the bin at the restaurant is thick and creamy I wouldn't walk away just yet. Take the oil sample just as you did before (in a clear container) but now you need to warm the oil up. Warming the oil up above the cloud point will melt any FFA's that have changed state. You can warm the oil by simply holding the container in front of the heater vent of your car or you can take the oil home and let it warm up and settle out there. The oil will slowly clear up and hopefully become translucent. Then you can make a decision on whether to collect and process it or not.

As you gain experience and knowledge with the visual and characteristic differences between good oil and bad oil you will be able to dip a stick into the bin and inspect the oil droplets as they fall off the stick. This is usually good enough for a seasoned Golden Fuel Systems burner to determine if it is worth their time in processing.

**Gathering Rule #3:** When proceeding to ask someone if you can take the oil, knock on the back door. All restaurants have a back door for receiving. Just knock on the door and ask the first person that answers the door if you can have their waste vegetable oil. Most of the time you will either get a 'yes' or a 'let me find out' and then they will find someone who does know. There is no real reason to bother the manager if you don't have to. This usually saves everyone time and hassle.

**Gathering Rule #4:** Don't bother with the practiced WVO speech about how you're working on this alternative fuel project and how you can run a diesel engine on waste vegetable oil and how you need their oil, etc. Most of

the time, they are busy with work and other customers and are not interested. If they're interested, they'll ask what you are using the oil for, at which point, you can go a little more in depth with your explanation if you want to. Otherwise, keep it short and sweet: "Do you mind if I take a little bit of your used vegetable oil?" usually does the trick.

**Gathering Rule #5:** Never take the oil without the restaurant's consent! This is the golden rule of oil gathering, and should never be broken. Doing so can spoil it for all WVO burners. Even if restaurant owners have to pay to dispose of their oil (like most of them do), they're still likely to view such unsolicited favors as thievery. There have been reports of people who did not ask permission and had the police called on them.

**Gathering Rule #6:** Once you start pumping, never pump past the settling line! The settling line is the point of the grease bin where all the solids have piled up, and the oil will be thick and creamy. You do not want to collect the creamy stuff. The creamy stuff will clog your pre-filter bags very quickly. Don't take oil from any lower than at least 2" above the settling line is a good rule of thumb to follow. We are all guilty of getting greedy for that wondrous, free, eco-friendly oil, but it's not worth your time and pre-filters to take the settled junk.

**Gathering Rule #7:** Never leave a mess at a restaurant grease bin. Try to keep your gathering as clean as possible. We don't want gatherers to be declined by restaurant owners because of the mess someone else made. They're giving us fuel, so let's return the favor by showing them the respect of a clean pull.

## Chapter 7 - Processing SVO for Fuel

Most people think that converting a vehicle to run WVO is the hard part, and getting the oil for fuel is the easy part. In reality, it's the opposite. While oil preparation is not overly difficult, there's a definite learning curve to it that's a very slow process, since you have to run it for a while in your vehicle and see how long it takes you to clog a filter before you know how clean it is. It is waste vegetable oil and it does take some work to get clean and the cleaner the better. So, here's our gleaned experience to yield the cleanest oil that time will allow.

Oil preparation actually starts with the gathering process. If you can, gather on a nice, sunny day, taking advantage of the sun's effect on the oil's viscosity. Not only does this aid in the settling process before you even gather the oil, it also prolongs the life of your gathering pump. Choose good, clean oil, pump from the top, and make sure your pump has a good strainer on the intake. If you're not using a gathering pump, use a pitcher (or something of the like), try to take from the highest point possible, and pour it through some panty-hose into your container. While you're pumping, watch the oil and search for the settling line. This is the point of the grease bin where all the solids have piled up, and the oil will turn thick and creamy. Don't take it from at least 2" above the settling line, as the stuff down there will just chew up pre-filter bags later on.

### 7.0 Letting Oil Settle

There are tons of ways to mass-filter oil out there, and the best rely on multiple stages. Settling is the process of allowing gravity to pull the heavy particles (solids) suspended in the oil to the bottom of its container. Properly applied heat can greatly aid in the settling process by reducing the viscosity of the oil. We accomplish this by painting the container black and setting it out in the sun. DO NOT use any type of open flame heat source under the container to aid in the oil processing. The intense localized heat will cause a convection current within the container which will stir up all of the contaminants that have settled to the bottom. This will negate all the work that gravity has already done for us. Not to mention the fact that propane is a fossil fuel, and using it to prepare our eco-friendly fuel defeats our overall purpose. We cannot say this enough! Settling is your friend! Take the time and let the solids settle out of your oil. Even waiting a mere week can make a huge impact on how clean your oil gets. However, most of us don't want to wait this long. Personally, I recommend at least two weeks, but you have to be the judge. It'll ensure you get the most out of your filter bags and the longest life possible from your Racor filter.

### 7.1 Pumping Oil

You will pump your oil many times during its preparation, whether it is gathering, filtering, or filling your fuel tank. Always pump from the top of your container. DO NOT put your suction filter at the bottom of the barrel. This will result in pumping up all the settled solids and cause you a lot of frustration, premature clogging of filter bags, and can also damage your gathering pump. Place the suction hose only a couple inches into the oil and start pumping. Continually monitor the suction hose and slowly lower it as the level of the oil drops, keeping it just under the surface. You should be able to see the submerged suction filter screen and will be able to see when you get to the settling line. Stop the pump before you get too deep. Now it is time to clean up and move on to the next gathering spot.

### 7.2 Filtering

After your oil has had some time to settle, it is then time to filter it. There are a couple of filtering methods. We use a couple of One-shot filtration units at the shop for their convenience, ease of use and unbeatable filtration properties. We filter down to 2 micron, matching or beating most vehicle stock filters. Filter bags are a great low-cost alternative, but don't have any water-filtration capabilities. You can make your own out of multi-layered bed sheets, or buy some Golden Fuel Systems 6-8 micron pre-filter bags. Our pre-filter bags can clean a hundred or more gallons before they clog but it is all relative to the quality of oil that you filter through the bags. If you try to filter really nasty creamy oil then the bag will clog rather quickly. If you use really good oil that has been settling for a couple of weeks then you will be able to get hundreds of gallons

through the bag before it clogs. If it's winter time, it's a good idea to warm the oil a bit before you run it through the bag. A low heat is best and propane burners are not recommended.

Convection is bad and will stir up all the settle deposits and redistribute them throughout the oil. You can use a submersible tank heater in your oil a couple of hours before you run it through the bag. We sell one style on our website that we have used for many years. Do not put it on the bottom of your container as this will also stir up any settled deposits with the thermal currents. Try leaving it suspended just about midway in your container. Do not get the oil too hot! We here at Golden Fuel Systems recommend pre-filtering oil that is between 80°F and 120°F. If the oil exceeds this temperature range then it is possible that it will cause the fibers of the pre-filter bags to stretch and will not work as designed. If you filter the oil at too hot of a temperature it is possible to let enough contaminants through the bag to seriously degrade the lifespan of your Racor filter on the vehicle.

Do not clean and re-use your filter bags for final filtration. We're not saying this to get you to buy more. We've tried our best to find a good way to clean and re-use the bags. We've turned them inside out and gently wrung them out. We've run hot water through them (backwards and forwards). We've washed them in a washing machine on the warm/cold cycle. Unfortunately, all attempts ended in stretched fibers and useless pre-filter bags. You may use them as a pre-pre-filter bag to catch large chunks and save on the new filter bags for final filtration.

After the oil is filtered, store your clean oil in a barrel or jug, preferably in the sun. Even the best of filters will still allow particles in the processed oil, and it never hurts to allow it to continue to settle in the ambient heat until you need it. When you're ready to pump it into your tank, be sure to pump off the top, as mentioned before, to get the cleanest of the crop. And you should still leave the last 4" or so, even of the clean stuff. Pour it into your next batch of unfiltered stuff and let it settle out again.

Don't ever think you can get away with not pre-filtering your oil. Every once in a while, you'll score some oil that's so prime looking that you know you can just run it right into your tank. Fight the temptation. No matter how good that oil looks, skipping the pre-filter stage will land you with clogged Racor filters. We speak from experience (but it was sooo clean! :). We don't want to rain on your pristine discovery of sweet oil; just think of how long your filter bags will last with this great stuff flowing through it!